

WHAT IS CLAIMED IS:

1. A high-stability flow control system for controlling a variable displacement pump, the flow control system comprising:
 - a metering valve in fluid communication with the pump for metering a pump output;
 - a regulating valve assembly for maintaining a pressure differential across the metering valve, the regulating valve assembly receiving a portion of the pump output of the pump as a bypass flow at a first pressure, wherein a valve output from the regulating valve assembly is at an interim pressure approximately equal to an average of the first pressure and a low reference pressure; and
 - an actuator connected to the variable displacement pump for setting a displacement of the variable displacement pump, the actuator receiving the valve output for determining a setting of the actuator and, thereby, the pump output.
2. A fuel metering unit as recited in Claim 1, wherein a second pressure within the actuator opposes the interim pressure.
3. A fuel metering unit as recited in Claim 1, wherein the second pressure is approximately equal to the interim pressure during steady-state operation.

4. A fuel metering unit as recited in Claim 1, further comprising a filter in fluid communication with the output of the pump for cleaning debris.

5. A fuel metering unit as recited in Claim 1, further comprising a first line connected between the metered output of the metering valve and regulator valve assembly for dampening a response of the regulating valve assembly.

6. A fuel metering unit as recited in Claim 5, wherein the first line is a static flow line.

7. A fuel metering unit as recited in Claim 5, further comprising an orifice in the first line.

8. A fuel metering unit as recited in Claim 1, further comprising a second line connected between the regulating valve assembly and cam actuator for providing the interim pressure to the cam actuator.

9. A fuel metering unit as recited in Claim 1, wherein the actuator includes a piston connected to a movable cam ring of the pump.

10. A fuel metering unit for controlling a variable displacement pump wherein the variable displacement pump receives fuel at a low reference pressure and produces an output at an elevated pressure, the fuel metering unit comprising:

first means in fluid communication with the pump for metering the output of the pump;

second means in fluid communication with the first means for maintaining a substantially constant pressure differential across the third means, and producing an interim pressure approximately equal to an average of the elevated pressure and the low reference pressure;

third means operatively connected to the variable displacement pump for controlling the output of the pump, a setting of the third means being based upon a difference between the interim pressure and an opposing pressure; and

fuel lines connected between the output of the variable displacement pump and the third means for providing the opposing pressure to the third means.

11. A fuel metering unit as recited in Claim 10, wherein the fuel lines are also connected to the low reference pressure such that the interim pressure and the opposing pressure are substantially equal during steady-state operations.

12. A fuel metering unit as recited in Claim 10, wherein the first means is a metering valve.

13. A fuel metering unit as recited in Claim 10, wherein the second means is a regulating valve.

14. A fuel metering unit as recited in Claim 10, wherein the third means is a cam actuator.

15. A fuel metering unit as recited in Claim 10, further comprising a filter in fluid communication with the output of the pump for cleaning debris.

16. A fuel metering unit as recited in Claim 10, further comprising a first line connected between the metered output of the first means and third means for dampening a response of the third means.

17. A fuel metering unit as recited in Claim 15, wherein the first line is a static flow line.

18. A fuel metering unit as recited in Claim 15, further comprising an orifice in the first line.

19. A fuel metering unit as recited in Claim 10, further comprising a second line connected between the third means and the second means for dampening a response of the second means.

20. A method for metering a variable displacement pump that provides fuel to an engine, the method comprising the steps of:

receiving fuel at a low reference pressure into the variable displacement pump;

pumping the fuel through the pump such that an output of the pump is at an elevated pressure;

metering the output of the variable displacement pump with a metering valve;

creating a spill return flow from the output of the variable displacement pump to allow for quick response when additional fuel is required by the engine;

regulating a pressure differential across the metering valve with a regulating valve, the regulating valve being in fluid communication with the spill return flow, wherein the regulating valve generates an interim pressure substantially equal to an average of the spill return and the low reference pressure; and

adjusting a displacement of the pump with a cam actuator connected to a cam ring of the variable displacement pump for adjusting the output, wherein the cam actuator receives the interim pressure to determine a setting of the cam actuator.

21. A method as recited in Claim 20, further comprising the step of providing a second pressure to the cam actuator in opposition to the interim pressure.

22. A method as recited in Claim 20, further comprising the step of damping a response of the regulating valve by inputting a metered output of the metering valve to the regulating valve.